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Mineralogical and geochemical criteria for the stratigraphic dismemberment of metamorphic complexes of the crystalline basement of the tatar arch (Russian federation)

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Abstract

© SGEM2018. The crystalline basement of the Tatar arch located in the eastern part of the East European Platform (Russia) is composed of the metamorphic rocks of different composition and genesis. The Tatar arch consists of two blocks of the basement. The North Tatar and the South Tatar blocks are separated by a faults system. The South Tatar arch is a granite-gneiss core of the basement. It is composed of Archaean-Proterozoic metamorphic complexes of rocks (granite-gneisses, gneisses, migmatites and granulite-gneisses). The moving zones that separate them are composed of metabasite complexes. Metamorphic rocks of the crystalline basement of the Tatar arch are formed under the conditions of the granulite facies of a regional metamorphism. The associations of rocks are combined into structural and material complexes, the largest of which are the Otradnenskaya and the Bolshecheremshanskaya series. Otradnenskaya series is composed of rocks of mafic composition (metamorphosed volcanogenic, volcanic-sedimentary and intrusive formations), while the Bolshecheremshanskaya series is composed of the rocks of high-alumina composition. Many researchers identify them with metapelites. Granulite rock complexes are migmatized and granitized in various degrees. The rocks of the crystalline basement of the Volga-Ural oil and gas province have been drilled by great number of boreholes. The most profound is the 20009 Novo-Elkhovskaya well as deep as 5.5 km. One of the most important tasks is the stratigraphic dismemberment of the metamorphic complexes of the basement. Because of the absence of paleontological remains for their dismemberment, the material composition of the rock complexes can be used (mineralogical and geochemical features). In this connection, the radiation samples were estimated in terms of the content of natural radionuclides by emitting elements-232 Th,40 K,226Ra with the determination of their activity (A, in Bq/kg). There are 5 packs of rocks in the section of Well 20009 Novo-Elkhovskaya correspond to the rocks of the high-alumina (Bolshecheremshanskaya series) and mafic (Otradnenskaya series) composition. Analysis of the distribution of natural radionuclides K, Th, Ra along the borehole section showed their close dependence on the mineralogical composition of the rocks. The highest values of radionuclide activity are associated with granitoids in zones of migmatization of high-alumina rocks. The concentrations of these radionuclides are related to minerals such as potassium feldspars, garnets, zircon and monazite. Thus, the distribution of K, Th, Ra in metamorphic rocks depends on their petrographic composition, and also clearly reflects the zones of migmatization. The regular distribution of radionuclides in the studied rocks can be used for the dismemberment and comparison of metamorphic rock complexes.

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Keywords

Crystalline basement, Geochemical criteria, Metamorphic rocks, Stratigraphic dismemberment

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